REMARKS/ARGUMENTS

New independent Claims 38, 50 and 62 are added. Each of the new independent claims recites a ceramic substrate that has (i) an impurity element-existent area wherein an impurity element is distributed in triple points of the crystal grains present in the ceramic substrate and further has (ii) an impurity element-nonexistent area wherein the impurity element is not locally distributed in triple points of the crystal grains.

Applicants discuss the benefits and advantages of one aspect of the ceramic substrate of the invention on pages 8 and 9 of the specification (see for example page 8, line 32 through page 9, line 20). The ceramic substrate having the structure recited in the presently pending claims is able to suppress the expansion of fractures by localizing separation of an impurity phase from the crystal grain at the boundaries between the crystal grain and the impurity phase.

In one embodiment of the invention the raw material is fired (e.g., subjected to high heat treatment) to form the ceramic substrate. Firing may help to diffuse certain impurities from crystal grains so as to result in their concentration at crystal grain boundaries. Impurities such as metal oxides (including metal oxides of rare earth elements) may be added to the raw material from which the ceramic substrate is derived.

The Office Action of September 30, 2005 relies upon Katsuda (U.S. 6,001,760) and Natsuhara (U.S. 6,458,444) as a basis for rejecting the claims. Katsuda describes the structure and/or phasic constitution of the prior art material at, for example, column 7, lines 29-39, reproduced below for convenience:

> Further, the present inventors have investigated the triple point (triple point formed by three aluminum nitride crystal grains) in the aluminum nitride sintered bodies, and found that the crystalline phase at the triple point substantially does not contain rare earth elements. From this result, it is conjectured that the rare earth elements exist as an extremely thin amorphous phase, near the surface or on the surface of each aluminum nitride crystal grain. Even at the triple point, it has

> been found that the rare earth elements exist only near the surface or on the surface of the crystal grains.

The absence of impurity-existent/impurity-nonexistent areas in the aluminum nitride crystal grain of Katsuda, permits any fracture occurring in the prior art material to propagate freely through the crystal grains. Unlike the ceramic substrate of the presently claimed invention, the aluminum nitride crystal grains of Katsuda permit fracturing to take place at the inside of the crystal grains. The ceramic of Katsuda has no natural grain boundaries to improve the suppression of fracture propagation.

Katsuda discloses that after firing, the oxygen of the prior art ceramic remains in the aluminum nitride crystal grains "to form a donor level in a band gap". In contrast, in the presently claimed invention, an impurity such as oxygen is at least partially removed from the crystal grains (e.g., by migrating impurities such as oxygen or an oxide to a grain boundary).

Katsuda further discloses that the rare earth elements "are uniformly dispersed to every portion in the sintered body" (see column 11, lines 26-28). The presently claimed invention, on the other hand, states that the ceramic substrate has both impurity element-existent and an impurity element-nonexistent areas, both with respect to local distribution in the triple points of crystal grains. Thus, in the claimed invention an impurity such as a rare earth element or oxide is not uniformly dispersed within crystal grains but instead has areas of existence and non-existence.

Applicants submit that Katsuda does not disclose a ceramic substrate having the triple point grain structure recited in the presently pending claims. Applicants submit that the structure described in Katsuda is different from the triple point grain structure of the presently claimed ceramic substrate.

Applicants thus submit that Katsuda does not anticipate the present claims.

Applicants further note that the disclosure of Katsuda with respect to favoring uniform distribution of an impurity element throughout the prior art grains teaches away from

the presently claimed invention. Applicants submit that those of ordinary skill in the art would not be led to the presently claimed invention because Katsuda discourages a ceramic substrate (e.g., a sintered material) having a nonhomogeneous or non-uniform distribution of impurity element-existent and impurity element-nonexistent areas.

Applicants further draw the Office's attention to the disclosure at column 11, lines 12-20 and column 11, lines 1-6, wherein Katsuda discloses that oxygen atoms and/or rare earth elements and/or oxides of rare earth elements are desirably dispersed uniformly throughout the prior art sintered body.

Thus, the presently claimed invention is neither anticipated nor rendered obvious by Katsuda.

Moreover, Katsuda does not recognize or solve the problem solved by Applicants. For example, Katsuda discloses the following with respect to the presence of impurities such as rare earth elements at the triple points of the prior art material:

> Further, rare earth elements remaining at boundaries and triple points of each aluminum nitride crystal grain form an intergranular phase. This intergranular phase disorders the crystal lattice near the grain boundary of each aluminum nitride crystal grain adjacent to others, and loosens adhesion between crystal grains. It is considered that the decrease of the volume resistivity of the sintered body has so far been impeded by such disordering at each grain boundary of crystal grains. In the aluminum nitride sintered bodies according to the present invention, even the disorder of atom arrangement at the aluminum nitride crystal grain boundary can hardly be seen. (column 5, lines 1-12).

Thus Katsuda does not recognize that a structure having both impurity-existent and impurity-nonexistent areas can solve the problem of low fracture resistivity.

MPEP §215.02 (citing *In re Sponnoble*, 160 USPQ 237 (CCPA)) makes it clear that the discovery of the source and/or cause of a problem must be considered in determining the obviousness of an invention. Moreover "a patentable invention may lie in the discovery of

the source of the problem even though the remedy may be obvious once the source of the problem is identified." *Sponnoble.*

Such is the case here. Applicants discovered that the inclusion of both impurity-existent and impurity-nonexistent areas locally distributed in triple points of crystal grains in a ceramic substrate may provide a substrate having improved fracture resistance. Applicants submit that the rejection of the present claims is improper because the Office does not give any patentable weight to Applicants' discovery of a remedy for low fracture resistance in ceramic substrates containing triple point structures.

Applicants thus submit that the present invention is novel and not obvious in view of the cited prior art and respectfully request the withdrawal of the rejections.

Respectfully submitted,

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